# A Prototype Remote Sensing Validation Site: Towards a Multi-Variable Approach to Validating and Scaling Remotely-Sensed Observations of the Water Cycle

PI: Brian Hornbuckle; Iowa State University
Co-Is: Witold Krajewski; Univ. of Iowa, William Eichinger; Univ. of Iowa,
Amy Kaleita; Iowa State Univ., Anton Kruger; Univ. of Iowa

**Abstract**

There is little doubt that active and passive remote sensing technologies can be used to observe many components of the water cycle. Despite their apparent usefulness, *the quantitative aspects of these observations are not well known.* There is wide consensus within the scientific and engineering communities that validation of these technologies is an important challenge. Validation is a necessary step before remote sensing can effectively contribute to further scientific developments in hydrology, and before remote sensing can enhance our capability to predict global water and energy cycles.

We propose to pursue the NEWS Grand Challenge by

*improving the quantitative value of remotely–sensed observations of the water cycle through innovative validation techniques.*

This is product–driven investigation focusing on the key research element of Understanding and the relevant sub–foci of assessment, synthesis, and analysis. This investigation will engage four NASA ESE System Components: Aquarius, Hydros, MODIS, and the LIS. We hypothesize that:

- remotely–sensed observations of the water cycle can best be validated through the use of a rigorous statistical methodology that accounts for variability in the data (including ancillary data) at a variety of space and time scales; and
- integrating other hydrologic processes and related environmental variables together (i.e. a complete water cycle experiment) to better constrain the specific hydrologic variable of interest is a powerful validation method that has yet to be fully exploited because of the lack of complete, high–quality, and long–term data.

The main objective of our proposal is the development of a small (1 $km^2$) prototype experimental validation site. The site will be extensively instrumented with both *in–situ* and remote sensors so that the complete water cycle and important ancillary data can be carefully characterized at several spatial scales for long periods of time. Initially we will focus on validating remotely–sensed observations of soil moisture. Validation of remotely–sensed observations of precipitation and evaporation will follow in subsequent investigations. We intend this site to be a community resource, and will supply the data generated at the site instantly to other researchers through the use of wireless technologies and the world wide web.

The PIs and Co–Is have international reputations in both active and passive microwave remote sensing as will as visible and infrared techniques. Collectively our team operates a vertically–pointing X–band Doppler radar, a dual–polarized L–band microwave radiometer, and a scanning Raman lidar. These instruments allow remotely–sensed measurements of precipitation, soil moisture, and evapotranspiration, respectively, three key components of the water cycle. Our team also has extensive experience in collecting *in–situ* data with tipping–bucket rain gauges, time–domain reflectometry, soil moisture impedance probes, and eddy covariance evapotranspiration systems. We will cooperate with colleagues at the USDA ARS National Soil Tilth Laboratory. We also plan to participate in SMEX 2005.